Notebook, N-87-01-27

This notebook was begun by Edison, probably in January 1887, but it may have been used as early as December 1886. It was possibly used at the lamp factory for notes on squirted filament experiments, nos. 39-142. The pages are unnumbered. Approximately 110 pages have been used.

file No 39 -

4000 of No 25 + dip
full dosage -
after got to mat took over
3/4 hour over flame to get
stiff mix to squirt die
stuck a great many times
used little heat as mat
hard cold but very soft
hot, towards end equalled
otter perhaps softened
not have used heat in
die - file perfect & glass
under Micro - moderately
tough & thick they will
fuse together in Carbon
dip almost impossible
to swap out,

I broke over half by my
knife dropping on them
after putting in Carbon box

Recd 2000 Lump Blk.
2000 25 1 dipi -

Mealy breaks in press
in exporting -

Want more 25 & less Lblk

file 40

2000 No 25

dis in Chloro + little dipd
not good dissolves. muchy
liquid - 1000 Lamplk -
pugged quickly - urgent
agitated as if lumps in
poor agitator - fels good
in the mouth, nothing

Memo No 25 not a good
binder for lampblack
should have some more
stuff dissolved out of it

fol 41 — 8/1000 dia —

4000 Carbonite well powdered

Chloroform & 8 drops dipi
put together & then poured on Carbonite
pugged very well, did not put
it on very hard — squeeled
fairly well but — break 2 or 3
times fils, shiny fine —

fils 42

2000 Lampblack
2000 XO 33 disolved
in dipi – Takes considerable
time to get it all disolved in
little butter dish by finger

Worked the combn down in
Mortar till it ceased to be
mushy & get an mass that
was not very brittle
Squirts perfect not a break
6,000 dia fils good
made micro, not shiny
Very tough, —

fil 43

2000 XO 20

2000 XO 33 — 33 dies in dipi
Ladies cement time to dis by rubbing

took very long time 1/2 hour in
mortar to gather so could be worked
in finger to mort, then took
15 @ 26 mm threading or sheating
it out while blowing to get
mort off enough. We put
it in press but squeezed so
rough was going to abandon
when finally put on heat it
then squeezed perfect, surface
fair shiny — If this is
good fil (thick cone) pug
harder or use less 33.

44 fil.

2000 ~~[illegible]~~ Carbonate

2000 No 37 -

in got only used Aldehyde to develop, only no deposit - Couldn't sport then put back in got a lot and in getting 2nd lot went got too high in press. Consequently when I tried put them in Carbon box 1st lot went in O.K. but 2nd lot all fell press - fels under Micros all shrunk insets were all burnt & los Valuable Ordnant glass therefore no good -

Mem

2000 lamp block
2000 27 cement agt
stiff compressed / to solid what
like marble - No 27 with very
little dipi is ok but when
proper quantity put it it
precipitate chip

2000 lampblack
2000 No 27.

Instead of mens oil dipi
used Aldehyde 4 10 drops
dipi — worked ok
Demi wont allowed
brush 4 muddy character
ok first half in small
pic... [illegible] then
put some heat, worst ok
then heat got too much
waited till it cooled
little then came ok squeeze
only face — file smooth

18046

2000 No 20
2000 No 27

27 drs in Aldehyde with
12 drops dipi –

Took quite a while to get 6 oz in right [illegible] bottle but as it got dryer it became viscous & it just could be made harder & quicker perfect – no heat – got all the file – filed smooth good – tools were file tough – when not applied

49 [illegible]

No
2000 31
2000 Lang [illegible]

No 31 dw in alcohyde
with 12 drops dipt

pelets - cont [illegible] stuff
was [illegible] equal
[illegible] pucu
[illegible] with
bottle [illegible] 49

Rough Dentures
I carry it but have
no faith in it —

46 fds

2000 No 31
2000 No 20

aldehyde + 12 drops dryd
for 31 — prep well
quickly & carefully gate
vacuum & get output

Cable made tested
& quite OK fold here
fine specks embedded
moulded & throwing OK
tough —

New

28 Cant find

Salvent, probably

one can be found

Issue for the rem

28 HG

49 fels

4000 No 29
2000 Lampblack

found 2000 wouldt do of 29
so poured that with LBlk
+ made another 2000 with
dipi as with first & put that
in - pugged admirably - but only
pelet (not viscous enough for
mgt wouldt agitate well)
heat (when it agitated fine -
fill (mgt but quite rough
(like looking =

50 fol.

2000 No 20
2000 No 29

hardness test great
solvent, fils very rough
bad – extremely brittle
pbq. fl.

Mem

Got no good solvent for No 30 Carbon filament, ~~[illegible]~~ when aldehyde or dipi evap not sticky, will have to find some solvent

4000 No 37

aldehyde + 12 drops
dipi. all dissolved
long time to get so could
get it in hand — worked
it sheets in hand. then
got wet could have been
made very much stiffer
wouldn't squirt except
heated die then perfect
beautiful glass stick
little — 8 or 9/1000 dia
should have been pugged
very stiff —

52

2000 1/50 4
2000 Lamp block 3"

No 4 dry in Mat poured
on Lamp block in Mortar
Purge to get wet
Not very smooth, very
little tendency stick
to mortar, no heat
spotted fairly well
fill good but very
rough surface —

53

2000 Lampblack
2000 No Carbonate ?
dis in dip in excess

pugged + put out to dry
worked it to a powder
with big die 9/1000 +
heat hot till ok
Horribly rough stuff
when came out hard band
overshot glass red on
dedent band enough on
finger - squeeze good

2000 Lampblack
2000 10 25 —

I missed labels so it may be Carbonate
melted 25 but don't think so
dissolved in excess dryer —
pugged in Werner till sheety then
put in butter dish for hours then
repowdered till a perfect powder
nearly dry 6@7 dia string
heat perfect agitation but
slow as pressure is great.
got over 100 could have got
more a finest lampblack
fed yet glossy surface
shiny metallic looking file
even free efflorescence + perfect
end on look metallic like
showing great pressure
think could have got powder
dryer — This is a new departure

2000 crumpblock
2000 NO 27

Although only no dept
get th dry powder

With 6/1000 die crinky with
8/1000 squirts ok breaks
easier, fraction not so
coarse as 5 & 6 not quite so
good surface but better
than any previous block
Except 54 — which I will
call standard. This I had
to bend over hot glass so
too stiff to open much of
necessity of finger used
fault blown hot,

No 56.

2000 Lampblack
2000 No 28

Aldehyde only - aldehyde
not very good solvent,
No viscosity to The Whole
affair if it agrees twill
be strange - Dry powder

No Cantogrent it No test,

57 –

2000 Lumpblack
2000 Rosamilin Hydrochlorat

Aldehyde only –

Squirts good – 9/1000 dim
very great friction – Extremely
stiff so it only bounces
fingers head bend/them on hot
plates some file good shiny
surfaces others very rough –
tough – for a Lumpblk file

58 Well purified Carbonite
KClo Kind dont puff - lots
ash -

4000 mg - Mat

with 2 grain Thymol each
large than a pea -
worked it down so powder
& only slightly damp -

Bottle Squeeze fair
but fits roughest Ever saw
broke up on finger

No test,

59-

2000 Lump Stk
2000 No 5 —

80 drops acid Cl pt

Squares, good but very hard

file Stiff had band over
glass rod - may have got
it too hot & burnt away
as I smelled amides —
file surface some sharp & fine
but most of it rough
surface due to friction in
die — Got it to dry
powder —

60

2000 L Blade
2000 1233

in Mod only

No good rough
breaks
No test

61

4000 No 23 alone

powdered — its drawn from
H_2SO_4 & water & gums
no solvent used as it
softens by heat,

Not Soft —

1000 Dolards
2000 Sugar in Mol &
Little Water pugged to powder
dried in radiator,
Squirt few breaks very
often but fair Elegant
try Variation, had to use
highest heat applied for
10 minutes or more - think
wants more Sugar
Oiled die (1) small
part,

63 4000 Carbonite Mal - 20 dips
pugged sheeted + stiff mixt made die sticks
somewhat - fils good @ flaws in some but if
could be fine powder it would be good.

After Chgn all broken - too much charcoal
in box — Split longitudinal perfect surfaces
ox 5 sec Bamboo ox color shrinkage
Considerable —

64. 4000 Cbt + chloroform only
worked to powder - heat die - squirts fair
2 sizes fils brittle when cold probably
be broken in Chgn - under micro - good

Broken in Chgn by too much charcoal
ng —

64½ 4000 Cbt 20 dps 750 bet in chloroform
1000 of the 4000 thoroughly dissolved then
then poured on remaining 3000 Cbt, pugged
+ mixt worked by hand sheeted over
of Cane + put in mixed as mixt
rather hard, wilduxpt at first

but by warming die a little & then cutting off heat file splendid, but die stuck several times on accounts lumps if these Cbt be got out worked again perfect. file shiny - glossy black surface I say purposed -

Broke in Cbn by too much charcoal.

65 - 4000 Cbt with Isobut & Chunk Coal say I exactly how I did it, it was an upright stiff -
oxidize in flame in 2 sec very small file surface like glass, no flaws or cracked appearance under high power Measalletto file split longitudinally, oxidize Cuban - extra bamboo shiny 10 mos shiny then bamboo after Cuban after oxidize, The Cubans were all. stuck together as well as split longitudinally probably if separated worked by ok but too much weight of charcoal. Evidently Isobut make Cbt low to melt larger than dipi

66 4000 Cbt. 40 drops Isobut in Ether - I have forgotten if this is right think it is good file die stuck only twice.

67. 4000 Cbt Coal tar in chloroform. sputter fume, die stuck twice, file perfect

after Cbn stuck together a few files separated from main bunch were ok showing bunch showed to separated, oxidize 2 seconds in flame shrunk very much surface shiny but considerable charcoal stuck to file, file not hollow but some split longitudinally - an extra has about bamboo color -
I say in original account 4000 Cbt with Coal Tar die in benzol + poured over it goes to pass as powder, requires great heat to remove very difficult agt. lumps Cbt probly trouble if Cbt wanted fine as Coal tar boiled down to thick its worked probly to ok

68. 4000 Cbt. No 25 + chlors only
powder - used heat, opts good,
surface not good - brittle,
After Cbzn all stuck together, Oxtn
7 sec swelled, pbly hollow., oxtn
Color better than bamboo but guess
its Ug —

69 - No 20 + Isobut alone used
put + got ongt ingot then kneaded dry
20 m - bad surface to file,
Ingots should have used heat ingot rots,
hard
Oxdtn test in flame 15 sec oxtn,
Silver Color, it would be ok if coned
prevent sticking - fils were all
stuck together best yet for oxdtn
Shrinks Considerable —

70 3000 No 20. 60 drops Isobut
ingotted it, oheated, ingot not very
stiff when put in press opts bad
Crumby - surface rough, used little
heat, went better, too much heat made
bubbles broke file = fils sheated
length. Thus stuff may against stiffer
After Cbzn fils fair but somewhat
stuck together — Very small fils
oxdtn in flame 7 sec which is good
for so small a flame, strong fil,
very flexible pbly because so small,
Evidently Isobut has a chemical action
which causes carbon to be carried away
as a gaseous compound, yet strong be
when we consider bulk of No 20 that
this is not so — Surface of fils dark
not clean, has longitudinal Crack
dont oxdize down to point but always
fullways when breaks because there are
opts which ox out, oxtn color
Very silvery shiny —

No 71. 3000 No 20 plenty chloro
20 drops Isobut + 20 drops dipi
when gathered spread the buttery stuff
out in butter dish to dry. It came off dish
polished, then pegged till pretty thin
let it dry in butter dish till brittle
Then rubd it to powder - fumes coming off
when put in die, a punch in fumes, turned
stick together - old ones, you had to
use heat, squirted perfect not a stick
surface dark not shiny, file good
Extraordinarily tough, can pull them
through fingers -

After Cbzn These were the only lot that
came out OK. got them all, straight a
good shrunk considerably but still
large file 0x3h in flame 10 sec
surface of file not shiny surface of OX
is bright not dull or dark but somewhat
shiny, in fact OX surface is better than
natural or made surface OX air
very clear, Cavity like dent go to
point

No 72 about 3000 Cbt 20 Isobut 15
dipi plenty Ether, brot to a butter + laid
out on dish to dry. Dries much slower than
71 — by shutting + drying funnel got
it to powder, used only slight heat,
just sufficient warm die. Cbt needed
was ground in gasolene flexible after
no grit, powder old have been made
much dryer - squirt perfect not a
break, file perfect just like glass
file not tough after drying

After Cbzn file broken, stuck together

73 4000 Cbt 15 Isobut 15cc Ether
no dipi - goes direct to powder fumes
coming it - its not perfectly dry 6/1000
die good but crumby 8/1000 squirt
perfect file good, glossy but not
a dead glossy

After Cbzn - Broken stuck

74. 4000 CBT 7 dipi. 15 cc Ether.
goes direct to powder not very
dry when goes on press
(note evidently loss of Ether condenses
water & present viscous wheel mix
bz but fractions)
Used heat continuing flashing
not flameless some are crinkly
8/1000 die agts good but slow
dent (end) other fingers to shape
mean enough —

After Cbzn — oxtu 5 sec in beaker
off end shows longitudinal split
surface in places glassy other places
asphaltic, very little shrinkage
strong on strait pull oxtu color
bamboo shine —

75 — Bl° test,
76 4000 CBT 7 drops Amilin
15 cc Ether agts good fels shiny
(not too brittle... No last)
no say, ...

77 — 4000 CBT Mammoth pea of
Chloral Hydrate 15 cc Ether direct to
powder no smell —
After Cbzn — fels large shrinkage
small. oxtu — flame 10 sec
end on glassy — surface few
just like untreated asphaltic fel —
no puffs — charcoal dull stick
Considerable ash which fuses
Oxtu color shiny not dull dent
ok to point, angular

78 4000 CBT 500 mg Chl Hy 15 cc Ether
went direct to powder, considerable heat
re ground on press, agts perfect
fels perfect, glassy not very
tough. Grids around fingers
but two large go into Carbon box
Oxtu flame 8 sec very little
shrinkage. Hollow in places —
split longitudinally ok color
little lighter than bamboo
fels stick, broken by charcoal
get a few —

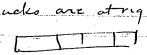
79 – 4000 Cbt about 400 mg say
12 drops Meta Kresol
15 cc Ether, went to powder, no smell
of Ether, file shiny good, aspects
fine, had been on Cross rod, may
have got it too hot. Thus fil slight
puffs as much as normal, fil not
very shiny, used heat on press

After Cbzn slight Coagellation got 1 or 2
too much charcoal broke chain
Cbd pbly bz Cbzd ok –

80 4000 Cbt 12 drops Kresol ortho
15 cc Ether, went direct to powder
heat aspts perfect, fil shiny
good, little brittle, dont melt in
flame some crumbs
OXtn 7 sec file apparently didnt
shrink at all which is strange
not aplit or hollow. Surface like
Asphalt file – OX color better than
Bamboo, dont go to point hilly
but no Cavities, file broken &
shrink Coagellation on Cbzn –

81 4000 Cbt 500 mg Bromal Hydrate
15 cc Ether direct to powder no
smell Ether, heat die spotted perfect
file perfect end on absolute perfection
but when I heat them over Cross
rod broke No test,

82 4000 Cbt, 500 mg Bromal Hydrate
15 cc Ether, get got die very hot,
otherwise file break – you must
expect very fast so get in furnace
before cooling otherwise the Grid is too
long & break – under microscope the
slow puffs pbly press too hot,
After Cbzn – Large file dont appear
to shrink at all – OX in flame
7 sec under microscope found to
all cracked – surface perfect
Cracks are at right angles to file:



OX Cbn block not always shiny
but Bamboo shiny

83 – 4000 Cbt, 300 mg Betol (Naphtalol) 15cc Ether.
Squirt, fine, heat, brittle towards last got few – had been overgelatinized some broke there fil file like surface on most, not very good fil. ~~Extr~~
After Clgn all broken, shrink together but probably could be made to work –
Ox in flame 8 sec no apparent shrinkage not hollow or split, surface shows streaks of dye
Much better than Ag small fil.
some fel rough but other have observ surface Ox color better than Gambos –

84 4000 Cbt 300 mg Menthol 15cc Ether, rough mg no heat,

85 4000 Cbt 300 mg Trichlorophenol 15cc Ether, Brittle mg no heat

86 – 3000 Blood albumen blackened by action that H_2SO_4 forming, plaster Mal + 30 drops dept – got to mg not but tough Chest pry with fingers picked it to pieces + dried on dish 1/2 hour then repurged got it so could just squeeze it + burning that it were dept. forced it of press in chunks fels fine + very tough, dent puff when put on flt in flame spits crackly otherwise good it had lumps in it as it dried spot perfect,

After Clgn Brittle all broken, by too much charcoal.

87 3000 Cbt, plenty Ether, 750 mg Chloralhydrate prepare to mg but very friendly could use half the amount, 9 sheet it + dry on dish, it gets dryer the Chetty Europe bulk is very small, get too much heat + ably too much chetty fing get only few fels –

after Cbyn OX 2 sec self oxides
after withdrawal from flame
surface perfect glass Hollow
Oxdn Color Silver
fils all broken stick together
too much charcoal in box
could be made to work

88 3000 Cbt 20 drops dipi
plenty zether 300 mg Chlthy
flooded burnt lime but guess
its 30 old its all Carb Lime
had bratte first cooling but by
heated new die got fils
nice — no stick after charging
die — fils good not strong
in flame Lime stays behind
appears to very high temp
after Cbyn Mg Grittes all
broken —

+89 —
No 90 3000 Cbt, 20 drops dipi
abt 300 mg Chlthy + zether,
Aluminum OX is in one magnesia OX
in other Cant say which are
powder — squirts fair —

No 90 — After Cbyn — Carbon ox
out in 10 sec oxide is left much
dirty had usage — dont
break in flame surface fair
pretty sticking out cant
say if it charcoal or not
there are puff spots [ ]

but full — when slightly oxidized in
flame Oxide makes a nice white
Coating — apparently not very
porous — OX is evidently not
reduced by Carbon fils
strong lengthwise, Griffs on
bending —

Ignoback + make some tests on file
Carbons which have shown well
before =
No 22 2000 Lampblack 2000
No 5 – Little more shiny than 54
has a glaze to surface as if
on point. Ox in 10 sec
ox to point, Color poor bamboo

No 43 2000 No 20 2000 No 33
~~23 ~~ ox 5 sec soft oxidized
spots dont go to point, puffed
badly Ox color very shiny.

No 8. Ox 5 sec ox color shiny
but not so shiny as 43.
goes to point but all glombe
rough + pieces unoxidized stick
out, shows pieces silica also
ash. Surface of file not so
good as aylsworth file –
Aylsworth file unbroken
Ox in flame 75 seconds
surface of file far more glassy
than aylsworth broken or unbroken

46 – Ox in flame 8 sec
Ox color silvery about same
as 43 – all puffed + worse
than 43 general color of
file not so glassy as 43
Some great cavities ox out.
if cured be gut solid would be
ok sure

54 – Ox 8 sec Color Lampblack
Ox to point. Surface of file
about same as unbroken
aylsworth after they have
been oxidized on surface
think the Carbon might give
fine results for flashing

No 92 -

2000 Induline No 33 2000 No 20
ammoniated by Ammonia Water then
Methylated alcohol -
dissolved 33 or Induline in 60 drops
dipi - pugged to sheet then dried &
worked to powder - fils rough surface
End on like lampblack Carbon, with
only moderate hot friction dry on dis-
made horrible surface: with more heat
got less hence surface rough like
Lampblack Carbon, dont bend to
Curve of finger but little bigger,
fils quite shiny - used small
amount of charcoal over file in
Clay box

After C fils has powered
original rough working surface
most of file have pic circy
fils good round End on
shiny but a pungy Cutter

No 93 – same as No 92 has more
Charcoal over fils – Clay box

Cf Cu Cbu

Shows Evidence puffs
very poor surface agld
bad pbly ng —

No 94 Is attempted duplicate of 43
used 2000 old No 20 that old 43 was
made with 2000 No 33 dissolved in
dipi – not all of it was dissolved – after
dissolving in small mortar, poured it on
No 20 + pugged till got ungot, then
sheeted it, Sheet had a good surface
dried sheet in flame, then dried it in
dish, then put in mortar + got to
powder, washed powder for say 10 minutes
dipi small not very slow
fils came with bad surface till got
plenty heat then came nice fils with
a lampblack surface probably about
like No 54 or 42. fils a bronze color
somewhat tough loops over finger
3" radius had we hot glassed –
No other liquid but Dipi used

Found I have 2 No 94 #
fils all Cracked got none
pieces show alot cracked
very silvery —
= note dont know which 94 I have =

Second No 94 Is duplicate of 43 but
we got too much heat on die it
was good but we let heat stay too
long so it made very irregular wavy
surface No 20 stiff was same
made with very little H Cl over and
above what was necessary for
combining with the dulfne Oil.
its water sol- dilut wash very
good tried no alcohol
used Equivalent amount of
No 73 in dip. — no other big pins
Can see that if we had not used
too much heat it would have
been OK pbly all the No 20's
will work = Cantony if above
was put in box or not,

NO 95 2000 NO 33 ~~[illegible]~~ 1000 NO 20

80 drops dipi only liquid used
all 33 dissolved but about 1/2 pea size – took 20 min
to dissolve + 20 more minutes to get it to a summer
butter consistency put it in butter dish to dry out
Takes 4 or 5 hours on butter dish before its dry
enough to work into my pot, it sheets well
poor surface to sheet, but can get sheet
Dry as your hand, sheet tough, I rind it
to powder in mortar in 5 minutes after I got
it to powder put it in press, had
trouble I spent it crumbed etc, but it was
always good, round fil two puffs –
used moderate heat The ones put in
Clay box were a few that didn't crumble
surface is about same as 54, fully as
good – not shiny, fils even, and is shiny
but not glossy
Remark Think this will get easy if the
die had a straight point or the stuff was
either dryer or wetter, a variation either
way is necessary in the Crumbl
Comes in if Crumbling did to d(app)
fils would be OK
After C
much better surface than 96 not as
good as 43 better than 54 shiny but not
clear shiny no puffs fils perfect

A

No 96 - 2000 No 33 2000 No 20.

90 drops dipi put 33 in dipi gradually grinding all the time, got it all dissolved perhaps few fine clots went in, should be strained No 20 was previously powdered in mortar, worked it in mortar only to a liquid like Molasses & then put it out on a dish to dry at 3.28 pm. powdered at 11 am the next day, there was still some sticky lumps in it, when sent to press strong smell dipi — for 1st 2 feet pulsing rolling fil, had considerable heat on then it went bad surface (a) good fils but bad surface owing to friction or dies, took heat off but fils only got a little better, looks just like a lampblack fil + I can see drag Cracks in places had bend them over not yet dried.

Depth C

preserve original Blk

Surfaces nice shaft no puff

End on nearly spongy all through

B

No 97 2000 No 20 2000 No 33.
80 drops dipi worked same as 96
put in dish at 355 pm. cuked to powder at
1 pm next day took over hour in
grinding + blowing to get it apparently
dry but still dipi would come off
used heat when finished file finally
took off die + you could see steam
coming out steamed like dipi —
pile are good but have no sign of shine
look like smut files and on shows
lots holes showing putting pile are
also much larger than die,
don't think they will have shiny
surface first foot came out
perfect like silver, think we used
too much heat,

after C
file perfect, think very little
shrinkage — no shine — lumps
surface no puff and a
porous

No 98 — 2660 N020 1330 N033
60 drops dipi put to dry at 8 pm —
it dried in lumps & I powdered it
next day when powder it was
strongly lump with dipi I
added 10 drops dipi dried to
powder made mixt, not very
stiff in one hour after I got
made sponge it, had few lumps
but acts good, one Gulch fit
ok others not so good, fit
round, Even, surface poor lampblack
surface but even, end on Jell not
good.

Cellon C
fit, perfect, no puff or Colapse
but shrink lampblack surface
not very silver like. shrunk some
much more than 97 ~~sept~~

No 99 2000 No 20 2000 No 33

33 put right into about 200 drops Chloroform it clots to one clot, I then put the clot down so apparently no lumps in it the clot was immersed in Chloroform slightly then poured the 2000 No 20 right in 1 gr. I should have previously ground No 20 but didn't, it has lumps, got it gathered to right wrinkles in filter, put it in press quite soft with Chloro smell clotting could have rubbed it much harder felt good, round, even but lumpy, lumpy surface, they didn't get shiny in heating on sand bath, on dipping right felt so —

after Chlor

felt good, rough surface not silky End in outer edge of Cotton holes

Sep good

100 — Duplicate of 43
2000 No 33 2000 No 20 100 drops
dipi — dissolved 33 in dipi filtered it
through muslin in to No 20 which
was previously powdered, got
mgot, sheeted + dried it & got
to wet very stiff mgot, load
very little heat on steam only no
steam — if too much heat puffs
if not enough rough surface about
150 deg flake Grit Ojuncto perfect
no stop or sticking of die
fels Lampblack like surface

Coffin C
Not perfectly round surface
rough not very oily
on sheet some lines
puff here I think —

Dup 43 - Variation

No 101 2500 No 33 2000 No 20
125 drops dipi - 33 dropped in dipi
+ filtered through muslin on to
No 20, mixt rather soft, takes
long time to get it to mixt by
wky in mortar + then sheded
filo fairly shiny little Gelt
~~Chrome~~ Lampblack;
Opaque perfect, very little heat
on die part filo shiny part
rough surface

101 - good filo shrinkage [illegible]
no puff surface puff but
always end on holes, shiny -

No 102 No 20 2000 No 33 2000
about 90 drops
Benzaldehyde - make thick
syrupy liquid with 33 m t,
that hardened can't say
get it to thin but spit
it on dish to dry dried
3 days then was soft
enough for mgt septo badly
stopped now + Allen
aft Cbzn
fils good but rough surface
file rasp on it

Dup 43 - Variation

103 & 103 A Bath the same

3000 No 33 2000 No 20 150 drops
dipi - solution of 33 in dipi filled
through muslin took over 2 hours
to pull into sheet & for 1/2 hour
2 then got it so dry machine
could scarcely rip at it, but
by holding over flame it soften
so I ripped it off. rip off
when warm only fairly hard
Could be made harder
fils good Lampblack surface
squares perfect only slight
bit on die no steam, but
go above 150 fahr. 100 101 + 102
& these are all squares with
small die

after Cbzn

Shrunk - shows tendency puff
very small little puff
surface rough not shiny
but an shiny but some buff
holes in Center

No 104 —

2666 No 20 1333 No 33

60 drops dipi — 33 — dipi filtered,
fairly stiff mixt it squirt fair
but if mixt had heat right
on dri — otherwise surface worse
than lampblack it probable
there was not enough of 33
but possibly fila would have
been better if mixt not so
stiff as it dont puff when
should right into flame

After Clean

Bad surface not so bad
Think see Cracks End on
apparently no holes

No 105 — 3000 No 33 1000 No 20

150 drops dipi - 33 dissolved in dipi solution filtered, after mixing well in Big Mouth to molasses like liquid twas dropped out by spoon spot in Butter dish to dry on radiator at 10 am —

at 6 pm took it off radiator part was solid part liquid wked it in water for 1/2 hour got it got worked it little by stretching for 5 minutes - left it in form of ball went to supper at 730 pm stretch it so it was fairly stiff cold, squirts perfect no break, fils lamp black surface pretty not quite so good small die used used very little heat on die no steam great deal of dipi steel coming off fils melt when ~~put on the flame~~ when thrown on hot dish put after supply dried fils were 3 hours before putting in bag fran these fils well p 46 or melt in Cbzg —

after Cbzn soft fils shrunk wrinkled some puffs fils bad cbz without sticking should say hd shrink in and come out bad condition slight bit of puff of Thumb nail [illegible]

106 – 2000 No 27 2000 No 20
100 drops dipi in which 27 dissolved, dots together and takes a very long time to dissolve by grinding dissolve, so far only after pouring & concluded from the looks it would not make an mgot so put in 20 drops Isobutylamine, got mgot rubberized at, it rubber like due to action of isobutan 20, can scarcely pleat it so tough & rubbery put it on dish to dry dried amine hours
Dried fil. 3 hours before pulling
– Cbg box

after C –
perfect fil. silver surface
but rough & pecks
had st. d. surface scrapped
wold be fine – one shrunk
x Cracks & puffs

106 seems missing ok

No 107 2000 No 20 1800 No 33
80 drops aniline oil – apparently dissolves it. it was clear & opaque put it on dish to dry –
after 3 days drying + 1 day on radiator stuff scrambled up
some pieces brittle dry, other
Viscous succeeded in getting
whole to powder, semi viscous with
slight heat on die only – squeezed
good except die stix every few fil
by specs on it. poly the dry pieces
fils good large die – surface
Lumblock like but good
on throwing fils on hot dish
puffs little, bals rgets glare
on tough fils can obtain
Used Dried fils 3 hours
before pulling + Cbg box
after C
shows slight puffs no shine
rough surface

106 2000 No 27 2000 No 20

100 drops dipi with 27. Clots together + takes long very long time grinding to get it to dissolve | dissolve to fair only pbly good deal in evaporation after purging. Concluded from the looks that it wouldn't make an ugly so put in 20 drops Isobut got ugly got rolled at it, to rubber like. Like pbly to action Isobut or No 20 hence can ocasionly sheet, clots material of malleable put it out on dish to dry. Dried 3 hours. Dried fils 3 hours before put in Cap

108 2000 No 27 2000 No 20

100 drops acetone, dissolves without clogging filters well, but goes to mushy ugly put in 10 drops linseed oil, didn't do much good. ugly mushy but still fair ugly. Cut sheet it only a little. put out dry on dish. Solvents of 27 don't appear make it sticky at the end of operation. —

27. softly, a base contrast well and good if decomposed ~~[illegible]~~ the base may not work. Ug — but when cast it coagulates very slowly under great pressure most glass perfect fils yet but heat & press it with press an exp to get more pressure they could be quenched — got a few fils but opened them bending over glass to put straight sides in any way to see how they clog after C-10 and four fils, fair not strong

No test-

2000 R027 2000 R020 175 drops
Wood alcohol.
found on filler ~~[illegible]~~ the 27 mal
Dol natural went through
washed filter with more mal to
get all in mixture on pouring to
wgt found it mealy - put in
8 drops aniline oil but
this didnt help it much
then put in 12 drops Isobut
this made wgt more viscous
but its sticky & somewhat
mealy so cant sheet it only
little & now dry it on drip

Ng - I didnt get it dry enough
had 9 dove so could have got
very extensible sheet very
tough tweed have squeeled
~~off~~ fine

No Test.

3000 No 20 1000 No 27
125 drops Mal.
Went to powder no ingot
Keeps wet long time
put on dish to dry
Ng Cant to put,

2000 No 20 2000 No 33 150
drops Mal — Mal didnt dissolve
all of 33 large clot in mall
g saw didnt dissolve so poured
into big mortar & drippd 20 in
powder, Dried Ng rough
tempt heat to get it
to put at cell —

2000 No 20 Treated with ammonia
water, strong, then washed Mal
1000 No 33 — 50 drops dipi
Ng no test

2000 No 20
1000 No 33 50 drops dipi
Came quickly to mush put
out dish to dry —
Ng —

2000 No 20
500 mg No 33 — 50 drops
dipi - purge quickly to bulles
set out dry fil too rough
got some flents that were
good but didnt polish
in hot bullen dish —

2000 X 020
300 mg X 033 45 drops Dipi
85 @ 90 % 33 dis — comes quickly
to myself put in dark to dry —
got to powder fairly dry
3" under of fil. plate
When very hot 3 ice 2 gots [illegible]
mg —

phenolalcin — in spoon melts to
80% sublime — There is left behind
clear which has enormous
Viscosity the Carbon from which
is absolutely perfectly glass
+ mirror like even under high
power means absolutely
perfect. nothing here left
green comes again when it
if chlorine bleachable
Could be mixed with
20 or nuclear — dipi —

Solvents for K027.

Chloroform ng
Alcohol OK
dipi only faw cloto it
Cp Aldehyde only partially solvent
Acetone treated NH4 good
Ether ng
Butylethanal ng
Amylen good
Acetone alone good
Ethylal good
Water only little
Ammonia water only little
Acetal only faw
Camphor Carbolic seem to good
Benzaldehyde pretty good
Benzol ng
Iso Butylamy Curious dissolves
perfect appear bleached
a little dry a little with
other Solvents
Cumene ng
Mesitylene ng
Orthoxylol apparently good

No 109 4000 Carbonite 5 drops
Ortho-Kresol — Ethy. work to
powder. Like perfect. Some puffed
die got too warm — feels very
brittle. Quite perfect, against
will puff CCl4 —

After C

Phenol perfection but in
Phenol uniform Colapsed & cracked
if did 6 days thought be perfect
no puffs brittle Can't aspirate.

No 110 – 2000 No 20 2000
Carbonate guanidine process.
100 drops Digi Cbt dissolved in digi filtered, wet sheeted over frame get it not too stiff
Lather hot but pretty stiff when cold. spots without heat. Cut
Quite well + Crinkly put bottle
heat on abt 150°. squirted perfect
fil. look sqr still like Lampblack fil
surface not quite so good
fil. even + fine at rather tough
but melt – frame Color fil
dead black. no sign of shine
Dried fil. 3 hours before pulling
in Cbgn box, on all dies

after Cbgn –

Dull seems rough. Unlike
is a Colorless stiff surface
rough not shiny end
shiny but stiff holes

No 112 missing

No 113 2500 No 33 2000 No 20

150 drops digi – filtered digi 33
Solution, used bottle heat and
only opts perfect fil. very
rough 3 X 10 sqr die. the
roughness over round die is pretty
due to wrong polish on sqr die

after Cbgn

fil. perfect – sqr fil. 3 X 10
No Cracks or pitts surface
rough but Color silver not
shiny yet end on chrome but
apparently not perfect
no holes

No 114 4000 Carbonite 6 drops
Ortho Kresol – Ether, Prepared
powder ether smell acid gas ether
first odor. Spots pulpit 3X10
squares well blotted
felt perfect surface perfect
shape, not tough but handled
easily without breaking

After C
Collapsed inwardly Cracked
shelly, ether gone,

another report
soap sgr felt shrunk
unequally unloaded
collapsed –

NO 110 — 2000 NO 20 2000 Carbonit
Gasoline process 100 drops
dipi Carbonit dissolved in dipi
filtered cold, got in jar, shaken
over flame, got it not extra stiff
when hot but pretty stiff when
cold squeezes without heat but
surface bad — feels crunky
put little heat on die say 150 Fah
then squeeze perfect file black
exactly like lampblack file
surface not quite so good file
even + perfect, rather tough
dont melt in flame char of
file dead black no sign of
fabric dried file 3 hours
before putting in Cbg box —
[illegible] die —

No 111 2000 No 33 2000 Carborite
100 drops dipi – No 33 dissolved in
dipi + filtered, pumped to get
out air 2 hours then pumped
by hand then obtained over flame
when it was so tough Can't be chucked
Cold it often very much on
flame get it off in get
over flame, Griffin when
Cold used about 150 deg Fahr
on die only squeeze perfect,
fels shiny not Lam polcoky
think they will crack open
Dried file 3 hours, and on
fall and or puff holes but file
are fine + perfect – shape!

after C

Nice round – all good surface
shiny but not dead smooth
to give mirror no pits
and shiny full holes

Solvents for Indoline free
arsenic No. 33 —
Ether Nq —
Aldehyde fine fair dries slow not sticky —
Light aldehyde I think is good solvent
yum to eat very light dries slow
Dipi first class dries fast not sticky
that good —

Isobutylamine 1st class turns red little
sticky, surface dull —
Anline Oil Could 1st Class think it
better than Dipi
Methoxycinnamic acid good —
Camphor Carbolic good
Chloroform fair not sticky dries surface not
Oil Hemlock dont dissolve —
Hypnon fair dont stick
Butylchloral good solvent surface
dull but somewhat sticky, something
in it try —
Cuminic acid fair dont dry
Paraldehyde Nq
Acetone Cooled with ammonia gas
perfect sticky
Acetone alone 1st Class
Benzaldehyde perfect not sticky
but thinny by when thick

Notes - Platina Spoon melts -
Jar of Sagapenum good about 1/4 goes to Carbon full white ash. Fetid smell.

Gum Ephobium 1/4 residue good Carbon but full white ash, fetid smell

Gum Olibanum nq

Gum Gamboge fine Carbon - 60% residue very little ash, Melts with great difficulty wld Clg OK Very viscous pharos if go quick -

Gum Aloes 1/2 residue very viscous Even when go slow it pharos Carbon good, but considerable ash might answer if coned get ash down

Soft Mexican Asphalt, 1/2 residue Considerable ash lumpy form Carbon strongly but fair

Gum Kino just perceptibly softens practically Carbonizes W.M. to a lime Compound 1/2 or more lime -

Gelatine puffs then Melts then Crackle to solid Carbon but lots lime

Catchu - D.W.M. lime salt

Gum Gum Lac "Melts 1/2 residue Carbon not very good some lime in it.

See No. 124
Therefore Thursday
Jan 27th (1887)
T.R.S.

No 116 4000 No 42 4000 No 33

42 had some fibre in it from filter paper so put it thro Bolting cloth. 33 dis in 325 drops dripped well dis & filtered thro one thickness filter paper clear solution poured on 42 in large agate mortar & ground for little while then whole put in saucer over radiator till it got syrupy then transferred it to Worker & pugged by stirring until got little stiff – divided it in two parts one part was sheeted & dried & run through rolls until I coaxed it sheet it with fingers – Divided this in two parts I will call one of them parts No 1 which will be the softest mixt – when cold No 1 quite stiff – without heat or die rapers great pressure fine good film but no shine, not perfect than LB – When die gets warm shine is perfect, am in doubt if there is any perf to film under these opticon have uneven places in diameter I No Therefore 116 put in paper boxes. Thursday 26th I think Thursday morning

No 117 No 2 part. could not work it by
shedding but could sheet it family
with over flames wd it until
could scarcely sheet it over flames
not solid when cold –
when died little warm or better than
No 1 not shine fine but not so fine
as No 1 I notice there is not many
bad spots in it but I notice some
of file larger than others, think it
will be necessary to use it dis only
& necessarily to a defenth temp
No 2 is 117

118 No 3 put to 118 got a little
harder by shearing over flame
than No 2 - when heat and dry is
moderate fels are perfect but
have beautiful Langbley surface
no shine, but as heat increases
shine comes on, shine very slow
+ minor but I notice shine first
larger than others also some spots
larger than others showing that
which you get the Mirror there is
grittly hence it will be necessary
to have less heat + get the Langbley
surface which will poly shine on
Clyde as 43 do

119 No 4 part of forgot 119

Got it to powder, rather dry still
it would show pestle streaks
in mortar, showing a stickiness
although apparently rather
dry. drop small wetness
put powder in with regular heat on
die wold not squeeze hit got to very
hot then it squeezed OK fine shiny surface
but not so shiny as 1 2 4 3 but it
crumbled badly the better it gets
the less the crumble don't think there
is as much powder with 2 4 3
but crumbles are bad if powder had
not been so dry it might have been
better. think No 3 is best
with well + even regulated heat
Evidently there are lumps in 1 2 4 3
which show in pounding those lie
they produce a bend also show themselves
embedded Evidently Manipulation of
ingot must be so as to stop this, rolls are
no stuff like 119 comes out stiff
Evidently forger too large. Must be
bent over glove hand

120 5.00 No 42 3.00 No 33

225 drops dipi 33 dro in dipi. If filtered through filter paper only about 3/4 I think went thro filter hence there is less than above proportion, 42 works nicely in dipi a considerable portion dissolves thus liberating considerable pp finely divided, The stuff dissolved out by Ether, Chlorr, + Benzol melts + gives mirror Carbon - very considerable amount of the yellow sublimate comes off if this could be carbonized or separated it would be good its so thick in Clogg 42 - upon the whole lum yellow Lumen Micro thus is due to coating of yellow needles of a sublimate, it soon goes off -

9. divide the cryst obtained by pressing + sheets above, into 4 parts.

Part 1 or 120 is cryst which was little harder to sheet than 116

The 42 having lot of filter paper fibre mt was ground + sieved thro bolting cloth, No 120 dissolved good without heat surface better than Lampblacky but with heat surface shiny but not as good as 116 its a cross bet LB + mirror specs of fib pretty from little crinky had a little heat onto gives shine dont appear to

to be any puff & they seem Even in size

No 2 part of 121 got it only little
harder shine about same as 120
file fairly Even dont think there is any
puff still there is cracks now then
& spots, Extra 42 over Equal 42
micro friction or size greater
& perfection of surface dummies as
42 measure

No 3 part of my get. 122
I got as hard as could by wheeling over
frame still it dont seem as hard
as get commencing 118 perhaps
due to nature of the stuff.

4th part of mixt 123

Was heated pretty dry + put on butter dish with another butter dish over it + left to dry all night in morning powdered pretty dry came off but still it appeared pretty dry probably as the individually particles had plenty depi moisture Reqmts die very hot can scarcely hold finger on it 1st lot fit very crunky but apparently good rout puffed brittle, will have to bend over glass rod 2nd lot has die butter but it came out puffed fairly brittle got none, dont think NO 4 is practical to mixt without something could be changed — press to get pressure closer to die + die itself heated only by copper rod

Memo
On 1st attempt quick Cbyn on little
prelim –
116 badly shrunk. 117 shrunk + puff
118. ~~[illegible]~~ no crinkled shrunk but
puffed – 119 no puff but fear not good
No 120 shrunk 121 fair but puffs
No 122 good with slight puffs
123 puffs no whole not good –

Saturday 20 May 1911

124 Tots $ase New 42 having no
filter fibre – but which does not seem to be
as stickly by dipi as old 42
powdered it in Mortar rest + ground it with 100
drops dipi then 3000 No 33 div in 200
drops dipi filtered through 1 thickness
filter paper about 1/2 wet dire + then it
went so slow I poured it out of
filter into 42 ground all + getting
Cut it in two 1/2 will work Monday
other 1/2 just quinine 1st part of
2nd 1/2 to 124 get more medicinal
dry used Copper red water on
die only fils good, better than Lily
a semi prime 9 quinte good
Dont think there is any puff –

125 a 2nd part of last 1/2
drawn little harder than 124
Ingots of thick surface worse
better than 124, but surface not
much better than 121 or 124 [illegible]
a second shine but handling fils
seem sandy even rolled no
[illegible] puff - thick Copper
Red heating is a success

130 - Stand two hours
in flame but broken
no film - posibly with
Propionic Acid &
Hydro Cl etc
with plenty lime

New Series -

Start 130 -

3 grams gasolene Carbonate.
500 mg Chloralhy. about
1/4 sqr inch thick mushy
Hydrate Lime - used about
two drops dipi in which I
put the lime, then put
whole of Cbt in ground +
finding it not very sticky
or shiny put in 15
drops dipi Extra
became viscous Shiny +

stiff to work - ungot quite
soft - The Chloral was
ground in Lime & dipt
dont Know if it dissolved
or not, no heat or die
squirts OK, fils shiny
but there is a limpy
appearance at places
put right in flame puff
only little Oxidizes &
leave lime = squirts
without a stop 8/1000
die =

NO 131 NO 2

3000 gasatened C6H6
1 gram CHHg(OH) in just
enough Mal to wet powder.
Worked in Mortar till powder
dry and Chloral smell
predominates —
.0054 die — use copper
disk and heat jets —
Squirts perfect 500 feet without
a flow to top.
fil measures 5 3/4 / 1000
there are Kinks fils
beautiful shine —
go over finger ok tender
go when dry

fils all Colapsed after Cozn

132 fils fine - tough -

Mal self Oxdy - 6 @ 8 sec in flame - Magnesia is reddish pbly colored with Iron fils on Oxdn nat free of flaws - nat so good as 136 for Evenness

No 1 Mould

132

3000 Cbt
1000 Chlty

The alcohol Mal being saturated with acetate Magnesia by boiling one minute, worked to dry powder - powder darker than when no magnesia in Mal, Symmetry perfect fils glassy but flaws in either because I didnt use enough Mal or didnt mix it good or limmed heat off too soon when it got running off = fil shew in flaws pbly Magnesia —

3000 Cbt
1000 Chl Hy
1/4 inch stick potash,

Dry powder —

Can't spread it although powder was dry the heat makes KO Combine with Cbt to produce [illegible] [illegible] —

No test

Same as above with Bromide Lime Hg —

Water

all shade

Vegallum - full flavor beside

No 7

133 -

3000 Carbonate

1000 Chlthyd

500 mg Salicylate Calcium

SiCa dis mal perfect not delignificant,

Mixers hard, as it seems to have solvent action of Cbt. powder is Gally

Squints when properly hot absolutely perfect, when not enough heat Kinky it stands a surprising amount of heat without puffing in the least,

3000 CCt
1000 Chl Hy
1 1/2 grams Salicylate Calcium
in small -
Couldn't get it to powder
only a half mort,
Couldn't get most stuff,
squirted perfect out
Little lumpy but was
tough & sticky, looks like
together Either Salica
prevents Hy Chl from
evaporating or else it
is a solvent itself -

No test,

134

3000 Cbt
1 gram Salicylate Calcium
Mal —
No Chetty —

Dry powder — with heat fils shiny but puffed when very little heat fils not shiny but very smooth lampblacky but perfect
Shows it has solvent action, pbly 250 mlgm
Chetty make it ok
puff in flame not great.
fragile filament,

All taken up when
filament

3000 Cbt
Saturated Soln Ethyl of
Anilin Roth Fuchsin.
The amount of Solution about
same as used in previous
fil. –
didnt get it dry
Enough w/ with alcohol
Certainly not get any fil.

No Cost

Original 7/1000 after
CBj 4 1/4/1000 -
fils not so good as
136 -

Possible that as we increase
Napthalene size will
diminish + get more
dense -

135 = NO 3

3000 Cbt
about 1/2 gram Napthalene
9 gasoline -
With great heat it was
a long time before anything
Came seems if it was going
be a failure finally it
Came fils OK but that
Shiny wants more Napthalene
that puff much in flame -

fils all broke at curves
before pulling in box

No 4

136 =

3000 Cbt

1 gram Naphthalene in gasolene not all dissolved say 7/8 dissolved - bad use

considerably more gasolene than necessary wet charcoal ground it well got to dry powder, & put powder on paper & held over flame till no gasolene smell.

~~Jet~~ Took very strong heat. Jets nearly 1 inch long before squirted, then they squirted fairly squirted perfect, while shiny no puff

End on - in spoon raw. pills do not puff but little oxide slow showing great density - This is most favorable of all the pills so far —

The pill smells of thunder comes out dire =

136 – oxidizes to a thread nearly perfect but not quite perfect for commercial cautions 1/2/1000 wt. – also fine wool successfully as fast as melted –

Its self oxidizing showing that its persons I noticed that it had contracted least of all this may be good their being no chance dont seem to be any air bubble cautions –

All Carbons came out good but crumbled some the bad as I puffed them by using rod to hot,

The fibs are shiny & will Carbonize & think with Charcoal to beautiful surface Altogether there is best fee in the lot,

Original fil 7/1000 Cbd 4/1000

137.

3000 Carbut
1000 Diphenylamin
in Mal – when poured on Cbt. it combined & made a stiff viscous sheet precipitating from Mal – I poured off Mal Could then pugged to dry powder used demi durable but Sequents perfect but allthough shiny fil they are not perfect spotty fils stiff – they puff great deal in flames –

138 NP10

3000 Cbt
1000 Trichlorophenol Mal

9 sets Viscous sheet pp in Mal like 137 - left Mal in + plugged + blowed till dry powder agnitt perfect considerable heat fits more shiny & better than 137 - No puff end or split they seem large p-double of 137 but have got large but think to expansion Due to heat puffs much in flame -

139- N011

3000 cbt
1000 Benzoic acid mal.
goes to powder - requires p'ing
little heat, sequent perfect
feels shiny but imperfect.
Wanty puffs badly
pbly ng —

140 1/11/

3000 Cbt
1000 Resorcin
Mal

Squeeze perfect film perfect
No puff - very small heat
Think it will puff in Carbog
I am going to make an
500 Milligm Resorcin - get
about 1 dry powder film
tough - pulling of powder in
mortar great until dry -

3000 Cbt
500 mg Resorcin monob.

When get enough heat to make
fels good & shiny it puffs
fels mg when golden so
don't puff fels mg —

Mg Notest

3000 Carbnt
Saturated mal sal fuchsine Rd
about same quantity as Mal
used when dissolving
pugged to powder | then
with mal hot mal &
500 mg Naphthalene
repugged to powder —
[illegible]

3000 Cbt
1000 Tetrodon in wal
the Cbt got worse about on
meal of [illegible] pound offmuc
& pungent to dry powder of
puffs [illegible] or spread [illegible]
[illegible]
Squirts [illegible]
[illegible]
[illegible]
Na
No test,

3000 cbt
1000 Acetamide mal.
dry powder, smells some
in spray is
No good) Cloudy spot in
Water)

3000 Cbt
500 mg Bromacetylurea
sprouts fair but wants
1 gram.

141 1 13

3000 Cbt

1 gm Salol. (Salicylate of Phenol)

Mat -

powder - Symmetr. perfect

no checks fills perfect shiny

straight leaves no puff due to

heat but rises fill chuck -

5/1000 Dies -

142 No 14

3000 Cbf

1000 Diphenyl Methane

Ether - as MacLaurin did

Squeals fine - family

among checks in file

fels not proffered but

Evan - some of fels got

more obnoxious others

on account of variation.

heat must get rather

hot die —